CLAIMS

1. A method comprising:
providing a sample comprising sulfate;
converting at least a portion of the sulfate to sulfur dioxide; and
continuously determining the sulfur dioxide.

2. The method of claim 1 wherein the sulfate is particulate sulfate.

3. The method of claim 1 wherein at least a portion of the sulfate is ammonium sulfate.

4. The method of claim 1 wherein the at least a portion of the sulfate is converted to sulfur dioxide by passing the sample over a surface.

5. The method of claim 4 wherein the surface is at an elevated temperature.

6. The method of claim 4 wherein the surface comprises a transition metal.

7. The method of claim 6 wherein the surface comprises stainless steel.

8. The method of claim 6 wherein the surface comprises chromium.

9. The method of claim 8 wherein the surface comprises chromium carbide.

10. The method of claim 8 wherein the surface comprises a chromium salt.

11. The method of claim 1 wherein the sulfur dioxide is determined by pulsed fluorescence detection.

12. The method of claim 1 further comprising quantifying the amount of sulfur dioxide determined.

13. The method of claim 12 further comprising determining the amount of sulfate converted to sulfur dioxide.

14. The method of claim 1 wherein at least 50% of the sulfate is converted to sulfur dioxide.

15. The method of claim 14 wherein at least 90% of the sulfate is converted to sulfur dioxide.

16. The method of claim 12 further comprising:

removing at least a portion of any particulate matter from at least a portion of the sample to produce a background sample essentially free of particulate sulfate; and

detecting a positive or negative sulfur dioxide response in the background sample.

17. The method of claim 16 further comprising subtracting the positive or negative response from the amount of sulfur dioxide determined.

18. The method of claim 1 wherein the at least a portion of the sulfate is continuously converted to sulfur dioxide.

19. The method of claim 1 wherein the sample is a fluid.

20. The method of claim 19 wherein the fluid is air.

21. A method comprising:

passing a sample comprising sulfate over a surface, the surface comprising a transition metal and being at an elevated temperature;

reducing at least a portion of the sulfate to sulfur dioxide; and

continuously determining at least a portion of the sulfur dioxide.

22. The method of claim 21 wherein at least 50% of the sulfate is reduced to sulfur dioxide.

23. The method of claim 22 wherein at least 80% of the sulfate is reduced to sulfur dioxide.

24. The method of claim 23 wherein at least 90% of the sulfate is reduced to sulfur dioxide.

25. The method of claim 24 wherein at least 95% of the sulfate is reduced to sulfur dioxide.

26. The method of claim 21 wherein the temperature is greater than 500°C.

27. The method of claim 26 wherein the temperature is greater than 800°C.

28. The method of claim 27 wherein the temperature is greater than 1000°C.

29. The method of claim 28 wherein the temperature is about 1100°C.

30. The method of claim 21 wherein the sample is a fluid.

31. The method of claim 30 wherein the fluid is air.

32. The method of claim 21 wherein the sulfate comprises particulate matter.

33. The method of claim 21 further comprising removing at least a portion of any sulfur dioxide that may be in the sample prior to reducing the sulfate to sulfur dioxide.

34. The method of claim 21 comprising removing particles of a size greater than about 2.5 μm from the sample prior to passing the sample over the surface.

35. The method of claim 21 wherein the sulfur dioxide is determined quantitatively.

36. The method of claim 21 wherein the determining is performed with a pulsed fluorescence sulfur dioxide detector.

37. The method of claim 21 wherein the sulfur dioxide is determined at a rate of more than one reading per hour.

38. The method of claim 37 wherein the sulfur dioxide is determined at a rate of more than one reading per minute.

39. The method of claim 38 wherein the sulfur dioxide is determined at a rate of more than one reading per second.

40. The method of claim 21 wherein the sulfur dioxide is determined at a rate of about 10 times per second.

41. The method of claim 21 wherein the surface comprises stainless steel.

42. The method of claim 21 wherein the surface comprises a chromium alloy.

43. The method of claim 21 wherein the surface comprises chromium carbide.

44. The method of claim 21 wherein the surface comprises a powder.

45. The method of claim 21 wherein the surface comprises a metallic chromium wool.

46. The method of claim 21 wherein the surface comprises tubing.

47. A device comprising:

a surface comprising a transition metal; and

a sulfur dioxide detector in fluid communication with the surface.

48. The device of claim 47 wherein an air source is in fluid communication with the surface.

49. The device of claim 47 wherein the detector is a fluorescence detector.

50. The device of claim 47 wherein the surface comprises chromium.

51. The device of claim 47 wherein the surface comprises at least 10%, by weight, of chromium.

52. The device of claim 50 wherein the surface comprises a chromium salt.

53. The device of claim 47 wherein the surface comprises chromium carbide.

54. The device of claim 47 wherein the surface comprises a stainless steel tube.

55. The device of claim 47 wherein the temperature of the surface is greater than about 500°C.

56. The device of claim 55 wherein the temperature is greater than about 800°C.

57. The device of claim 56 wherein the temperature is greater than about 900°C.

58. The device of claim 57 wherein the temperature is greater than about 1000°C.

59. The device of claim 58 wherein the temperature is about 1100°C.

60. The device of claim 47 wherein the surface is disposed in a quartz furnace.

61. The device of claim 55, 56, 57, 58, or 59 further comprising air flowing across the surface.

62. A method comprising:

passing air comprising particulate matter across a heated surface comprising chromium, the particulate matter comprising sulfate;

reducing at least a portion of the sulfate to sulfur dioxide; and

determining sulfur dioxide.

63. The method of claim 62 wherein the sulfur dioxide is determined via a pulse fluorescence sulfur dioxide detector.

64. The method of claim 62 further comprising removing at least a portion of any sulfur dioxide from the air prior to passing the air across the surface.

65. The method of claim 62 further comprising excluding particles of a size greater than about 2.5 μm prior to passing the air across the surface.

66. The method of claim 62 further comprising pretreating the air with ammonia.

67. The method of claim 62 further comprising correlating a concentration of sulfur dioxide determined with an amount of sulfate in the air.

68. The method of claim 62 further comprising heating at least a portion of the surface to a temperature greater than about 500°C.

69. The method of claim 68 wherein the temperature is greater than about 800°C.

70. The method of claim 69 wherein the temperature is greater than about 900°C.

71. The method of claim 69 wherein the temperature is greater than about 1000°C.

72. The method of claim 71 wherein the temperature is about 1100°C.

73. The method of claim 62 wherein the surface comprises stainless steel.

74. The method of claim 62 wherein the surface comprises chromium carbide.

75. The method of claim 62 wherein the particulate matter is classified as PM 10.

76. The method of claim 62 wherein the particulate matter is classified as PM 2.5.

77. The method of claim 62 wherein the air is passed continuously across the heated surface.

78. The method of claim 62 wherein the sulfur dioxide is continuously determined.

79. The method of claim 62 further comprising filtering at least a portion of the particulate matter from the air sample to produce a second air sample;

determining a positive or negative sulfur dioxide response in the second air sample; and

comparing the determined response in the second air sample with a response determined in the air sample.

80. A method of measuring particulate sulfate content in a fluid sample comprising:

providing a sample comprising particulate matter;

continuously contacting the sample with means for reducing the sulfate to sulfur dioxide; and

analytically determining sulfur dioxide in the sample.

81. The method of claim 80 wherein the means comprises a surface having a temperature greater than about 500°C.

82. The method of claim 80 wherein the means comprises a surface comprising chromium, and the surface is at a temperature greater than about 800°C.

83. An apparatus comprising:

means for continuously converting at least 50% of any aerosol sulfate in an air sample to sulfur dioxide; and

means for detecting sulfur dioxide in the air sample.

84. The apparatus of claim 83 wherein the means can convert at least 80% of any aerosol sulfate in the air sample.